



# SAM HOUSTON STATE UNIVERSITY

## UTILITY AND ENERGY MANAGEMENT PLAN

FACILITIES MANAGEMENT  
November 2017

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# **SAM HOUSTON STATE UNIVERSITY**

## **Utility and Energy Management Plan**

### **Executive Summary**

Sam Houston State University consists of 241 buildings (4,286,659 Sq. Ft). Campus buildings include General Purpose, Residence Halls, Auxiliary, and Agriculture Buildings. There are two Dining Halls, twenty- two non-institutional buildings and 2 Swimming Pools. The campus is heated and cooled by three central plant operations, along with several buildings having stand-alone boiler systems.

Conserving energy and water on the SHSU campus must become a practice for faculty, staff, and students. The Utility and Energy Management Plan must receive leadership endorsement and a collaborative effort to support activities that would conserve electricity, fuel, oil, gasoline, and water. The campus must develop a culture that values energy as a strategic resource. Methods for conserving energy and water should be practiced and re-evaluated from time to time to determine if the plan in place is producing results and ensure facilities are being operated and maintained efficiently. This plan will be reviewed and updated in FY 2020 to determine if reduction goals have been achieved. SHSU Facilities Management proposes a proactive daily approach to energy conservation. We contend that through better management, use of current technology, and education of employees and students, a reduction in energy consumption and cost saving will be achieved. To maximize SHSU fiscal resources associated with energy use, a change in the way SHSU operates and plans for building and equipment improvements is required. Recommendations are included in this plan for both new building construction and operations.

As part of the SHSU energy conservation effort, a Campus Energy Manager was hired to oversee this plan and resolve utility issues. Currently, this position is responsible for auditing and prompt payment of all the campus utility bills. The bill payment effort is being assigned to the newly created business center. This will allow for the Campus Energy Manager to provide assistance to the energy impact of construction projects, review utility data, analyze consumption trends and focus on optimizing consumption and cost.

This plan focuses on strategies to reduce the SHSU campus Energy Utilization Index by 5 percent below the average base line established in FY2015. The reduction goals include: existing buildings, new construction and renovations, central plant operations, energy data collection, behavior programs, and the building automated systems.

## **Introduction**

SHSU Facilities Management (FM) supports the University's instruction, research, and public service programs by operating and maintaining the facilities both effectively and efficiently. The department is committed to reducing energy consumption, implementing energy conservation programs, and supporting responsible use of purchased energy resources. The continued growth of the campus presents the opportunity for FM to develop an energy plan that will accomplish reductions in energy consumption per square foot and improve operation efficiencies.

## **Utility Procurement**

Entergy Texas provides electrical service to the SHSU campus. To ensure a better price per kwh, SHSU purchases electricity on a Large Industrial Power Service rate. The service enters the campus at 13,200 volts through one primary metering point. Power is then stepped down and SHSU becomes responsible for the electricity distribution throughout the main campus. Entergy Texas also provides electrical service on a General Service and Small General Service rate to sites not located on the main campus. Mid-South Synergy provides electrical service to the campus ranch located outside the city limits.

Water to the main campus is supplied by the City of Huntsville. Again, for a better rate, the service is supplied on an Institutional Rate and distributed by the SHSU water loop. The Woodlands Joint Powers Agency provides water to the Woodland campus. Rural water systems supply water to various offsite locations.

Natural gas is purchased with the assistance of a contracted energy consulting firm to help ensure the best market price and transportation agreements are obtained. CenterPoint Energy supplies the natural gas and a transportation agreement is currently in place with CenterPoint Energy Services.

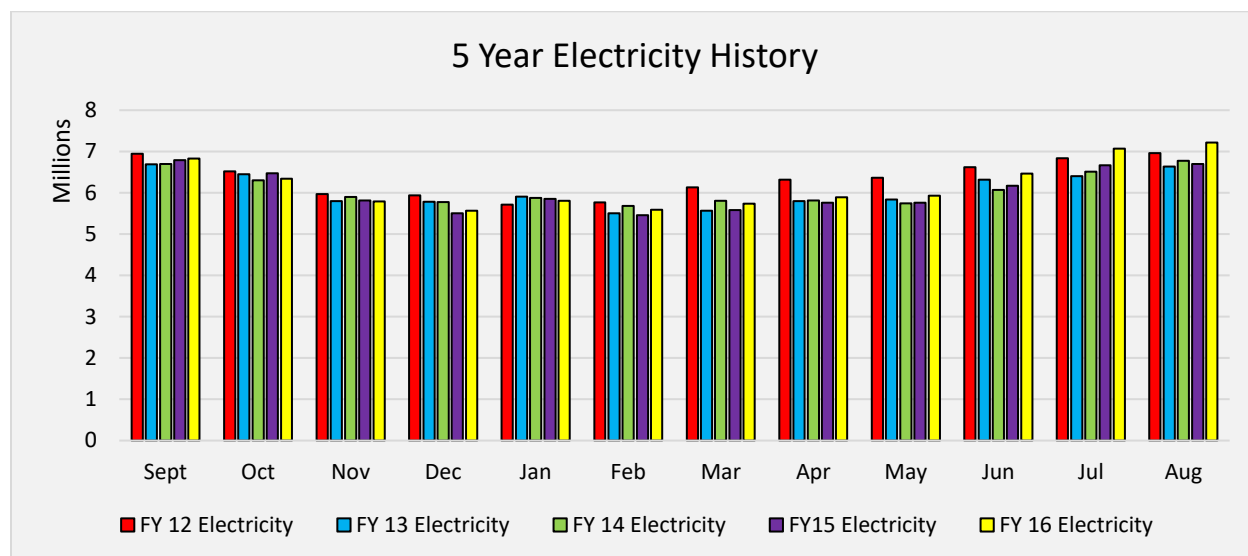
## **Existing Campus Energy Infrastructure**

The Campus is served by three central plant operations. The West Plant provides chilled water to 586,746 square feet and hot water to 199,014 square feet. Recently, the hot water boilers were removed from the East Plant operation due to costly repairs needed to the distribution system and the equipment was relocated to buildings that had been served hot water from the plant. The East Plant provides chilled water to 1,668,516 square feet. An infrastructure project is currently underway to connect the two loops. Another plant is located in the College of Humanities and Social Sciences Building (CHSS) and at this time the chillers are partial operated. Currently, the CHSS plant only serves the 147,422 square foot building with chilled and hot water.

A utility infrastructure master plan update was recently completed to plan and provide recommendations as needed to ensure continuity of distributed utility service. As the campus continues to grow a need for increased capacity at both the East and West Plants will be required. The plan includes improved plant and building monitoring to ensure the systems are operating appropriately and efficiently.

## **Historical Consumption**

The chart below shows total historical electricity consumption over the last five fiscal years. Electricity is used for plant operations, indoor and outdoor lighting, and several buildings use electrical reheat for humidity control.



## **Historical Initiatives**

- **Detailed Energy Audits**

In January 2010, SHSU contracted with Schneider Electric to perform an Investment Grade Audit. The purpose of the audit was to determine a scope of work, guaranteed savings and define utility cost reduction measures (UCRMs) for the possibility of SHSU entering into a performance contract. The audit consisted of evaluating 3,520,765 square feet of Educational and General Purpose buildings. UCRMs consisted of lighting upgrades, water conservation, building envelope improvements, mechanical modifications, Building Automation System (BAS) upgrades, and improved energy monitoring.

- **Finance Strategy**

Due to the lengthy payback and high implementation costs associated with the proposal from Schneider Electric, SHSU decided to self-fund many of the recommended energy conservation measures. A plan was developed and split into three phases for a budget total of \$4,470,000 to fund the defined energy conservation measures.

- **Energy Phase I and II**

In 2012, SHSU contracted with Johnson Controls to perform a comprehensive lighting assessment survey for approximately 80 campus buildings. From this survey, 21 Educational and General Purpose buildings were selected for upgraded lighting systems. The work was completed in 2 phases. Including cooling and maintenance

savings the project projected a simple payback of 4.42 years based on investment after rebate and first year's cash savings.

The project consisted of new light designs and installing one-lamp 2/4 kits with a prismatic lens to distribute light evenly in the classrooms. More than 60 percent of the new fixtures have one four-lamp that consumes only 25 watts of energy. The maintenance inventory was reduced from more than 13 different ballast types to four and more than 18 lamp types to six. The average rated life of a lamp went from 10,000 hours to more than 50,000 hours.

- **Energy Phase III**

Being aware that an energy monitoring platform is an essential tool in controlling utility consumption and cost Facilities Management developed a scope of work to address the improvement of the Building Automation System (BAS) and electric metering. Billing of clients for energy expenses related to the central plant is currently based upon square footage.

The BAS front end and computer hardware were upgraded, three workstations were added, and one server was upgraded to the latest Continuum version. Chilled and hot water meters were included in the project for nine Education and General Purpose buildings that will provide electronic data back to the BAS for monitoring. The metering for this project has been completed and the programming details are being refined. This upgrade will provide an improved method to bill clients for central plant expenses. Measured usage will be used rather than an allotted square footage. The new equipment will better track the efficiency of the central plant operation and help to ensure central plant operations are optimized.

Also, as part of this phase, a scope of work is being develop to Retro-Commission the Criminal Justice Complex (CJC) and the Chemistry and Forensic Science (CFS) buildings. The scope of Retro-Commissioning on the CFS building will include the HVAC system, BAS system, and all related equipment such as fume hoods and vents. The CJC is a much older building and will include HVAC system, BAS system, and electrical systems.

- **East Plant Boiler Relocation**

Due to aged and leaking distribution pipe that was too costly to repair, ten natural gas boilers were removed from the East Plant hot water loop and relocated into several campus buildings. This project is expected to improve the efficiency due to utility costs associated with moving water and leaking pipe. The natural gas usage for each building is being monitored to determine consumption and cost savings.

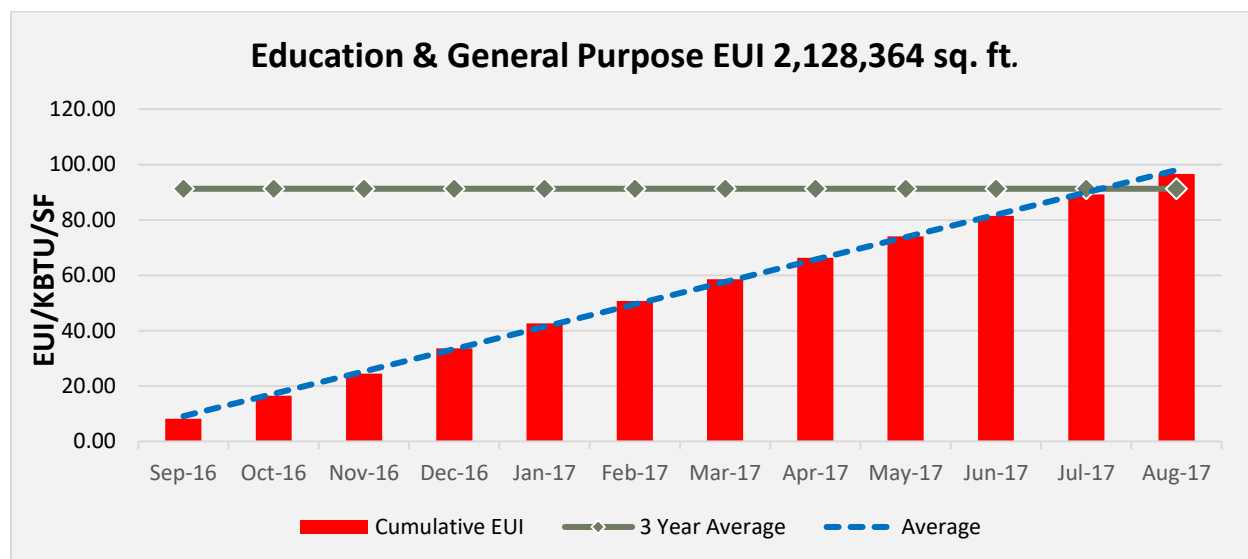
- **Axillaries and Resident Life**

The Lowman Student Center consists of 128,081 square feet. The building is home to the University Bookstore, Kat Klub Entertainment Center, Campus Ballroom, and Theater. All lighting at the center has been replace with T-8 and LEDs.

There are 26 residential facilities on the SHSU campus. Recently, outdoor lighting equipment was replaced with LED lights at the BearKat and Sam Houston Village apartments. Also, the aged HVAC units were retrofitted at the BearKat Village apartments with more efficient DX/Heat pump units. Both projects were submitted for incentives from the Texas SCORE program and the department received \$15,206 in cash rebates that can be used to fund other energy savings initiatives.

- **Educational and General Purpose Buildings**

The cumulative FY17 Energy Utilization Index (EUI) for E&G buildings was 5.65 percent above the previous 3 year average (91.25). Several reasons can be associated with the increase. Natural gas consumption was increased due to the boiler relocation project. It was several months before all boilers were operating efficiently. Numerous chilled water line breaks occurred during the campus infrastructure project. Three parking lots have been constructed requiring electricity; however, due to the limits of the current utility tracking system allocation, the consumption is charged to E&G but not associated with building square footage. Several E&G buildings are being renovated such as the Lee Drain and Thomason Buildings. Construction power for the LSC expansion was tied into the campus distribution. Also, the BAS connection to the Pirkle was not in operation when the building was opened which resulted in a higher energy use.



## Campus Benchmarking Assessment

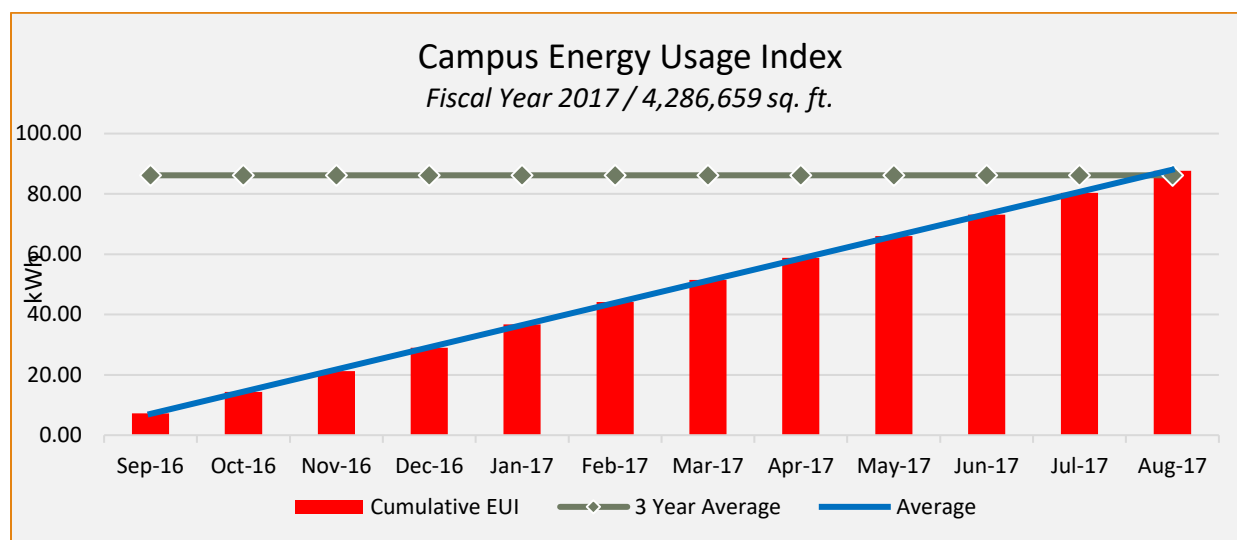
Benchmarking is the process of accounting for and comparing current energy performance with its established energy baseline. This serves as a mechanism to



measure energy performance over time and compare to the established baseline to track measurable energy performance and improve efficiency.

- **Campus EUI Benchmark**

The chart below indicates the FY 17 SHSU Cumulative Monthly Campus Energy Utilization(EUI). The goal is to reduce the cumulative EUI for the campus 5 percent by the end of FY18. By reducing the current energy consumption by 5 percent, SHSU could save an estimated \$129,824 in annual energy cost. This will be measured by using the annual cumulative EUI for the campus and compare to a baseline prior 3-year average. For FY 17 the 3-year average was based upon FY14, FY15, FY16 cumulative EUI average.

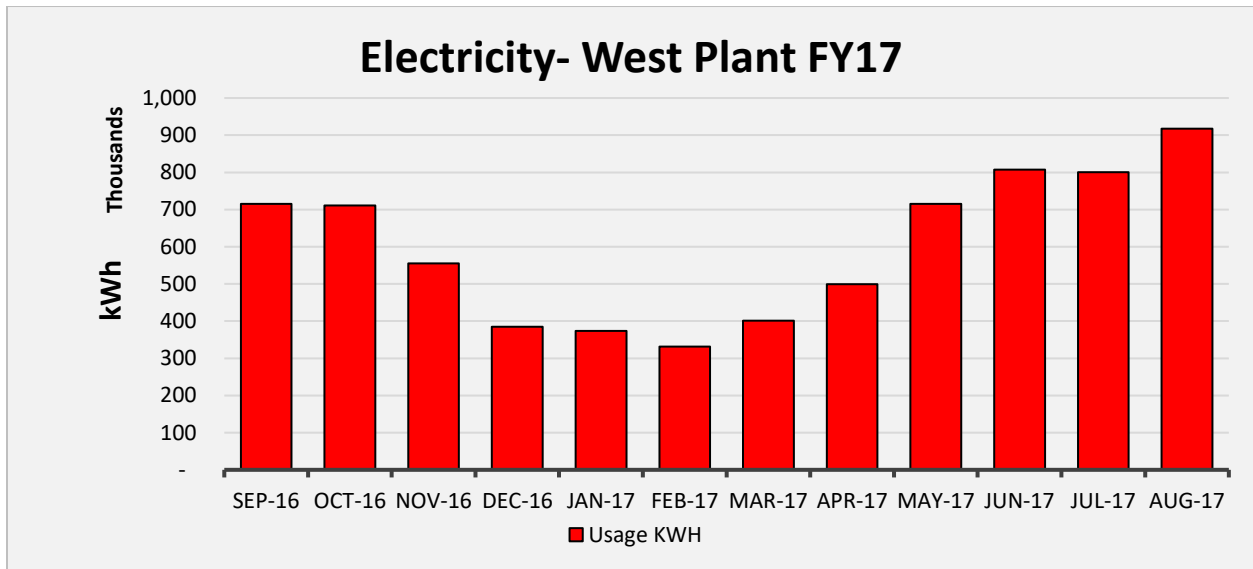
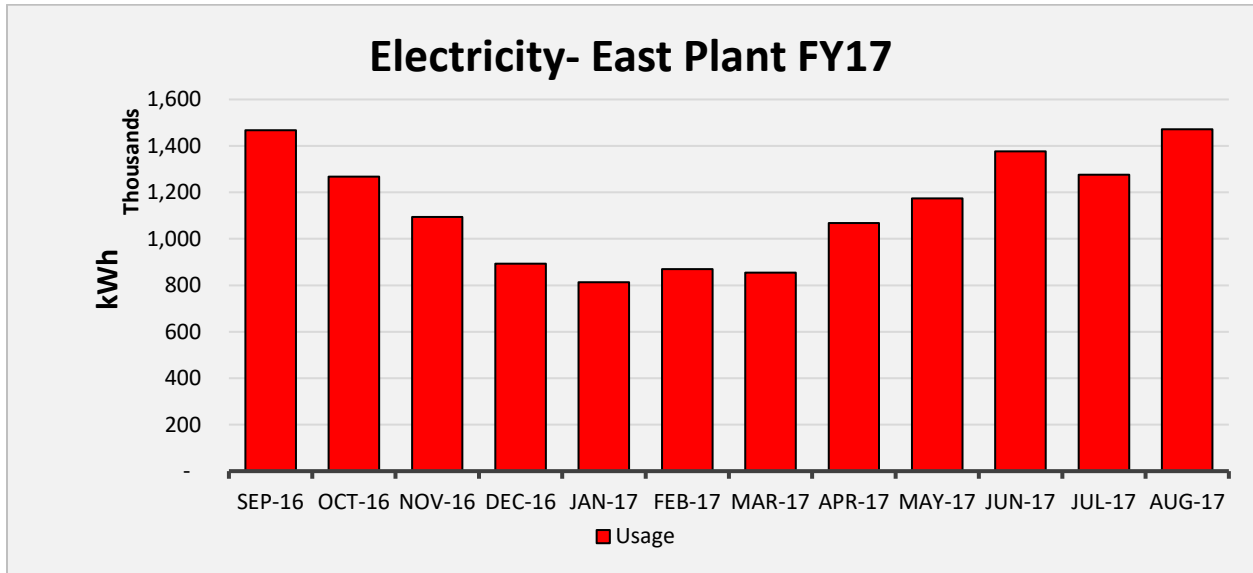


- **Central Plant Operations**

The SHSU campus has three separate central plants that provide chilled water to cool the buildings. Two central plants provide hot water to heat buildings that do not have a stand-alone boiler system. The comfort level for the campus buildings is managed with the Building Automation System (BAS).

The August 2017 Campus Utility Infrastructure Master Plan Update reviewed the campus chilled and heating water system and it was noted that one of the primary deficiencies with the distributed thermal utility system is the lack of metering and monitoring. Improved Central Plant operations and an improved Building Monitoring is essential to ensure the efficiency of the system. Each building requires supply and return temperature/pressure metering, flowrate pump status and speed. Accurate data can then be logged, benchmarked and trended for continued energy savings improvement.

Currently, the East Plant provides 4,200 tons of cooling capacity equaling to an electricity usage of 7.84 kWh per square foot served. The West Plant provides 2,200 tons of cooling capacity equaling to an electricity usage of 13.44 kWh per square foot served.



## **Progress Report**

The Facilities Management Department is in the process of changing its organization structure. The University recently hired a new Associate Vice President for Facilities Management and a Director of Facilities Management Business Services. The position for Director of Planning and Construction and Maintenance Services remains vacant. Currently, the Utilities and Energy Management section works under the direction of Business Services.

## **Strategies for Achieving Campus Energy Reduction Goals**

### **Strategy 1. New Construction**

SHSU Facilities Planning and Construction is dedicated to supporting the Board of Regents' vision of long-term planning and construction management of the campus plan for new buildings to support campus growth. As buildings are being planned and equipment costs are evaluated a review process must be put in place to ensure long term operating cost are efficient.

- **Design Standard Compliance Certification** - All State Energy Conservation Office (SECO) documents will be completed by the confirming Architect or Engineer and submitted to SECO. The SHSU Project Manager will ensure copies of the Compliance Certification is provided to the SHSU Campus Energy Manager.
- **Cost Control** - Value Management plans involving building equipment and lighting changes will be shared with the Director of Facility Services and the Campus Energy Manager review and evaluate the operating cost analysis. This information will be shared with the maintenance and building operations team. All value management changes that are related to the building's energy use must be approved by the Associate Vice President of Facilities Management before being incorporated into the design and construction.
- **Commissioning** - Commissioning ensures that the new building operates efficiently as designed. It is an intensive quality assurance process that begins during design and continues from construction to occupancy, and prepares the operations staff to maintain the building systems and equipment. To ensure new buildings have systems that are designed, installed, tested, and capable of being operated and maintained to perform as the design intended, commissioning will be considered at the start of each building project. A process will be established to identify the best commissioning scope for each new SHSU construction project. The new Biology Building that is under construction is being commissioned during construction. Also, SHSU is involved with two retro

commission projects. The commissioning reports have been reviewed and a plan is being developed to complete the work.

## **Strategy 2. Building Operations**

To keep SHSU buildings operating at peak efficiency, ongoing maintenance is vital. Each building on campus is different, designed for different uses and managed in different ways.

- **Preventative Maintenance** – A Preventative Maintenance (PM) manual should be developed and made available for the Campus Energy Manager's review, defining schedules for cleaning ducts, changing filters, and other components. The PM document should indicate dates equipment was serviced and any issues associated with the equipment. HVAC systems in a typical building can be responsible for more than 40 percent of the total energy use. Maintenance must be performed on a regular basis to help reduce energy costs and extend equipment life. Quality operations and maintenance practices such as continuous commissioning can improve energy performance by 20 percent and improve occupant comfort at the same time. SHSU is in the process of hiring a Director of Facilities Services. Also, the work order tracking system is being reviewed to improve the preventative maintenance tracking.
- **Develop a BAS Energy Team** - The objective of a BAS is to achieve an optimal level of building HVAC system control and occupant comfort while minimizing energy use. The HVAC schedule must be optimized, a clear and consistent building objective must be established. Heating and cooling should be provided only when a building/ space is occupied. Set points during unoccupied periods such as weekends, spring and winter break. This group will meet regularly with the Campus Energy Manager to review meter data and find opportunities to analyze schedules, inefficient equipment and opportunities to save energy. This strategy can be put into place after a Director of Facilities Services is hired and the infrastructure project is completely developed.
- **Automated Lighting Controls** - Expand the BAS operation to include lighting controls so a more stringent and accurate control of the time lighting is on and off can be in place. This will allow the Control Specialist to make program changes that alter schedules and modify the control operation so lights will not be on in an unoccupied room. The use of sensors should be reviewed when the Director of Facilities Services has been filled.
- **New equipment** - Any electrical appliance, equipment, computer, or lighting will be required to have the Energy Star label before it can be purchased and put into service. This strategy is a no cost initiative and shows a commitment to saving energy.

### **Strategy 3. University Policies**

Developing and publishing University Policies will provide a method to establish standards and expectations for energy-efficient performance for new construction and renovation, equipment, operations, and procurement to be used by the FM staff and the campus.

- **Facilities Management (FM) Policy** - This internal FM policy will focus on defining the tasks and responsibilities to ensure the department is committed to planning, operating and maintaining the campus facilities efficiently. New buildings will be planned for optimum energy utilization and achieve the lowest life cycle operating cost. When purchasing equipment an energy life cycle cost analysis will be developed and evaluated. All projects developed by the FM Planning and Construction section that affect energy use will be shared with the Campus Energy Manager prior to design completion. Any major equipment installation, lighting retrofits or operation changes by FM Maintenance will be reported to the Campus Energy Manager. Application for cash incentives and rebates for new construction, lighting, and major equipment installation will be pursued with the campus electric utility provider.
- 
- **Campus Temperature Standard** - A campus temperature standard is currently under development. As part of the work effort for this project, data related to TOO HOT and TOO COLD calls is being analyzed by Plant Operations to determine if all equipment is functioning properly before a standard is established. A comfort range of 70° - 75° is being recommended. Before implementing this initiative information will be shared with the campus explaining the details of occupancy and HVAC operations.
- **Energy Star Policy** – The purpose of this campus policy is to ensure consideration of energy use when products using electricity are purchased. All products, appliances and equipment purchased by SHSU shall be ENERGY STAR certified. This policy will be completed in June, 2016. Communication to the campus will be coordinated with SHSU Purchasing and Procurement. This type of policy has been adopted to like sized universities and provides a no cost commitment to saving energy.

### **Strategy 4. Management**

As the Sam Houston campus continues to grow it is important that we minimize the energy costs of operating SHSU facilities through monitoring, data collection, controlling, and communication. Collecting detail meter data is valuable for finding and quantifying energy-saving opportunities. For energy-saving opportunities to be successful energy awareness must be communicated.

- **Data Management** - A robust utility billing software is currently being implemented. The automated system will provide a method auditing and bill verification, internal invoicing and cost allocations, budgeting and forecasting, energy project assessment and day-to-day reporting. The system will have the capability to connect the BAS to automatically receive electric meter data, along with chilled and hot water flow to the buildings. Campus energy trends can be easily compiled, analyzed and building use can be benchmarked with Energy Star to assist in identifying savings opportunities, identify issues or problems. Utility consumption easily tracked, analyzed, and reported.
- **Staffing** - Adequate personnel resources to develop and track energy saving projects must be secured. The staff is in charge of monitoring, reporting, analyzing and acting on issues leading to energy waste and opportunities for reduction. This staff will focus on the development and accuracy of the utility database management system. This includes EnergyCap, Portfolio Manager, SHSU and SECO monthly utility reporting.

### **Strategy 5. Energy Awareness**

Successful energy management programs depend on employee support and participation. SHSU employees must become aware of energy management goals and assist in helping the University achieve reduced consumption and operating costs.

- **Behavior campus campaign** - This campaign will focus on adopting a last-person-out strategy. Stickers will be placed on the light switch plates in areas that are not controlled by automation and individuals will be encouraged to turn off lights in unoccupied offices, classrooms, conference rooms and restrooms. The campaign will encourage building liaisons to check these areas as leaving the office for the day, especially before weekends and holidays.
- **Tips for conservation** - A method to report energy waste will be added to the Energy Management web site, along with simple tips to conserve energy. Conservation efforts will continue to be shared with the campus by participated in as many campus-wide events as possible. A booth has been hosted at Welcome Week and Earth Day/Week to help raise awareness among students, faculty, and staff.
- **Building Liaison Reports** – Building liaison reports will be produced quarterly and forwarded with energy saving information for each building on campus.

### **Strategy 6. Shut Down Schedule**

During the scheduled Thanksgiving, Christmas, and Spring Break “Shutdown” procedures will be implemented. Heating and cooling temperatures will be set back and where possible buildings will be shut down. Checklists encouraging staff to unplug appliances and turn off lights will distributed to the campus.

## **Strategy 7. Sustainability and Water Conservation**

A sustainability project was kicked off in November 2017, with Residence Life to raise awareness of water consumption and energy efficiency. Collaborating with the SHSU marketing department, a sustainability logo and hashtag were created for the campaign - #SHSUGoesgreen. Brochures and posters were distributed to the students along with conservation awareness tips shared using Instagram and Twitter. The cost for this project were offset by utility rebates.

A water audit of irrigation controls and processes will be conducted in the effort to identify the reason for high water consumption. Also, the central plant operations will be reviewed to determine the cooling tower cycles and methods to improve the water used in the central plant operation.

## **SECO Resource Efficiency Plan – Certification Plan**

**State Energy Conservation Office  
State Agency/Institutions of Higher Education  
Resource Efficiency Plan  
Certification Document**

Date: November 30, 2017

Agency: Sam Houston State University

REP contact: Sandra Gray, Campus Energy Manager

REP contact telephone number: 936-294-1867

REP contact email address: [skg009@shsu.edu](mailto:skg009@shsu.edu)

The Resource Efficiency Plan for Sam Houston State University has been completed in accordance with 34 TAC §19.14. This document is the acknowledgement of the completion of the REP required by 34 TAC §19.14(a), and an assurance that the recommendations contained in the REP will be implemented.

Name:

Title:

Signature:

Phone number:

Email address: